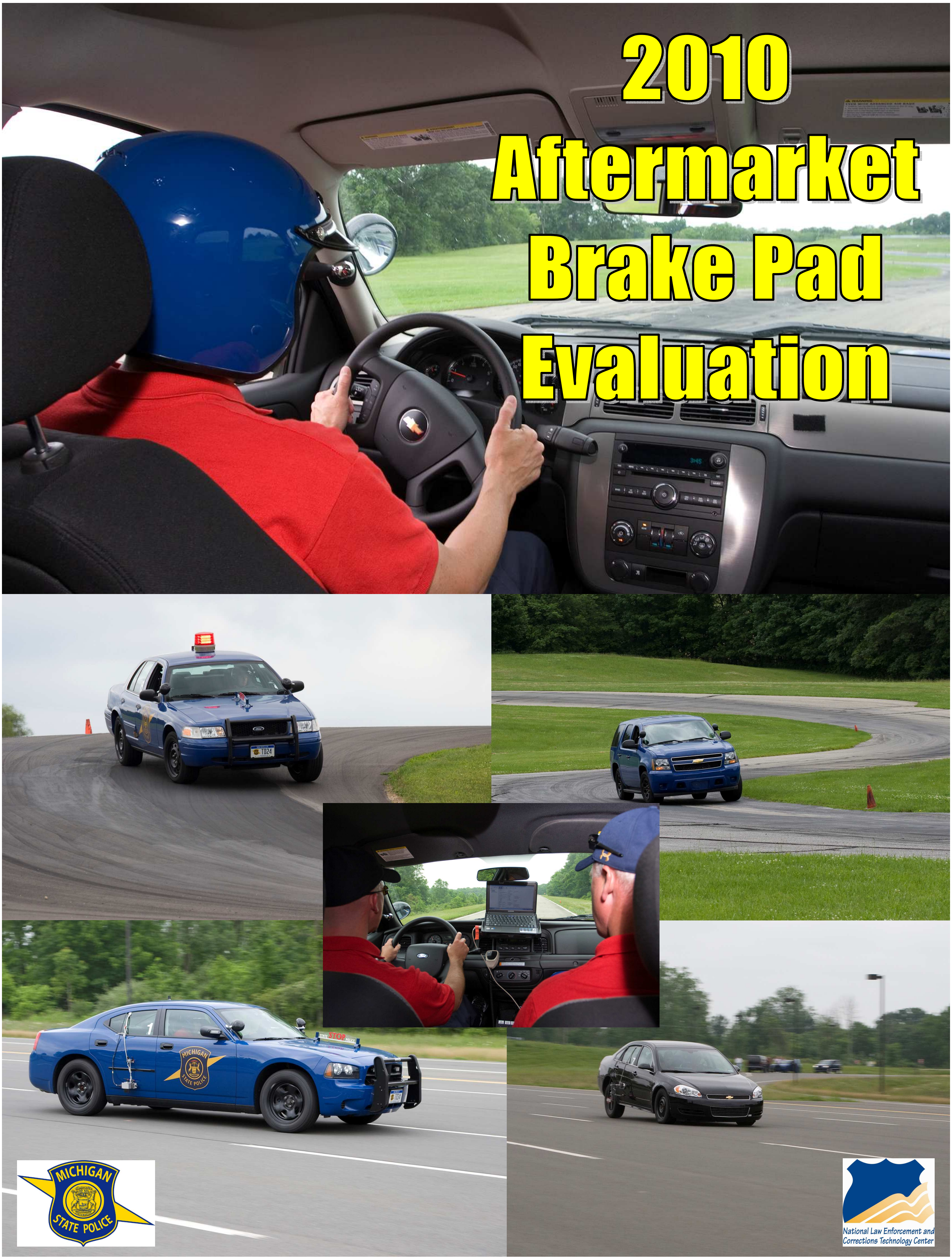
2010 Aftermarket Brake Pad Evaluation



STATE OF MICHIGAN
Department of State Police
and
Department of Technology, Management and Budget

2010 Aftermarket Brake Pad Evaluation

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Contents

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Michigan State Police Vehicle Test Team:

Lt. Keith Wilson, Sgt. James Flegel, Sgt. Ronald Gromak, Sgt. Matthew Rogers, Sgt. Rick Stevens, Sgt. Doug Schutter, Tpr. Mike McCarthy, Tpr. Sarah Whitman, Tpr. Brian Dewyse, Ms. Sheila Cowles and Ms. Jo Klotz.

Introduction

The evaluation project, conducted during summer 2010, provides law enforcement agencies across the country with information to help them make informed decisions regarding replacement brake pads.

Conducted in two stages, Stage 1 of the evaluation involved laboratory tests executed by Greening Testing Laboratories, Inc., using ‘matched sets’ of replacement brake pad materials in dual dynamometer test facilities. The laboratory used requirements of Federal Motor Vehicle Safety Standards (FMVSS) 135 as the standard for testing. Michigan State Police (MSP) Precision Driving Unit staff conducted Stage 2 testing at Chrysler Proving Grounds in Chelsea and Grattan Raceway Park in Belding.

For Stage 1, MSP solicited candidate aftermarket brake pad material samples from 28 different manufacturers offering “severe duty” products for police vehicles and also posted a solicitation notice on the iFriction Web site (http://www.factsaboutfriction.com/). The top three aftermarket candidate brake pads in each vehicle category following Stage 1 testing moved on to Stage 2.

In Stage 2, MSP used four full-service police vehicle models for the evaluation: the Ford Crown Victoria Police Interceptor, Dodge Charger 5.7L, Chevrolet Impala, and Chevrolet Tahoe. One vehicle from each category was equipped with a control sample fitted with original equipment (OE) brake pad materials included for comparison purposes. All vehicles in the evaluation were tested with OE brake rotors. Tests consisted of measured straight line stops from two different speeds and timed laps around an enclosed road course.

Results show significant differences among the various brake pads submitted for evaluation. Differences between the aftermarket pads tested and the OE pads have been quantified.

This aftermarket brake pad evaluation did not address brake noise, normal wear life, or friction material chemical compositions, including heavy metals.

For more information on the brake pad evaluation tests, please visit the JUSTNET Web site at http://www.justnet.org/Pages/brakepads.aspx. For more information about the full range of NLECTC’s products and services, visit us at http://www.justnet.org or call toll free at (800) 248-2742.

Test Equipment

The following test equipment is utilized during Stage 2 of the testing.

KISTLER-CORRSYS DATRON SENSOR SYSTEMS, INC., 40000 Grand River, Suite 503, Novi, MI 48375

DLS Smart Sensor – Optical noncontact speed and distance sensor

Correvit L-350 1 Axis Optical Sensor

Shoei Helmets, 3002 Dow Ave., Suite 128, Tustin, CA 92780

Law Enforcement Helmet – Model RJ-Air LE

AMB i.t. US INC., 1631 Phoenix Blvd., Suite 11, College Park, GA 30349

AMB TranX extended loop decoder

Mains adapter 230 V AC/12 V DC

AMB TranX260 transponders

PYROMETER

Raytek, hand-held optical pyrometer, Model Raymx2U

Stage 1 Testing

All aftermarket candidate brake pads were submitted for prescreening and laboratory testing to Federal Motor Vehicle Safety Standard No. 135. Vehicle manufacturers must certify that every new vehicle sold in the United States meets all applicable FMVSS at the time of manufacture. The criteria in FMVSS 135 establish a minimum equipment and performance standard defined as “necessary” to meet the needs of motor vehicle safety. After prescreening and lab testing, the top performing brake pad candidates for each vehicle application continued on to Stage 2 testing.

Not all submitted aftermarket candidate brake pads were able to meet the minimum requirements of FMVSS No.135 and were, therefore, removed from the pool of eligible test candidates.

This standard specifies equipment and performance requirements for service brakes and for parking brake systems. The purpose of this standard is to ensure safe braking performance under normal and emergency driving conditions.

FMVSS 135 applies to passenger cars, multipurpose passenger vehicles, trucks, and buses with a gross vehicle weight rating (GVWR) of 7,716 lbs or less.

It is important for the reader of this report to understand that FMVSS 135 establishes minimum performance standards by which auto manufacturers must comply. No federal regulations govern the performance of aftermarket friction material.

After FMVSS 135 qualification and prior to vehicle testing, each qualifying aftermarket friction material candidate was subjected to an FMVSS 135 200-stop vehicle specific burnish at Greening Testing Laboratories. All the vehicle-tested brake pads were submitted to the MSP team with a blind-coded identification and shipped with the rotors used in the burnish conditioning.

Stage 2 Testing

To eliminate possible bias, Stage 2 testing was conducted as a "blind test." Thus, information regarding the candidate brake pads, make, model, and manufacturer was not provided to the test team until after all Stage 2 testing was complete.

Phase 1 and Phase 2

Phase 1 and Phase 2 of vehicle testing included two series of 10 measured 60-0 mph straight line full antilock braking system (ABS) stops separated by a vehicle-specific cool down sequence to reduce brake temperatures at the hottest axle below 100 degrees C. This portion of testing was conducted on the east-west straightaway of the Chrysler Proving Grounds, Chelsea, Michigan.

Phase 3

Phase 1 and Phase 2 were followed by six measured 125-0 mph straight line full ABS stops. These tests took place at the Chrysler Proving Grounds on the high-speed oval. Each high-speed stop was followed by a 4.5-mile cool down lap before executing the next stop in the series.

Performance Driving

This portion of testing simulates actual conditions encountered in pursuit or emergency driving situations in the field, with the exception of other traffic. The evaluation is a true test of the vehicle and braking components' ability to withstand demanding conditions.

Each vehicle is driven over the course a total of 32 timed laps, using four separate drivers, each driving an 8-lap series. The final average lap time for the vehicle is the combined average (from the four drivers) of the 8 laps for each driver during the 8-lap series.

Wear Data

Disc brake pad wear is a highly nonlinear response function of a number of vehicle and friction material characteristics. In general, higher wear rates occur at higher speeds and at higher temperatures but the comparative wear rates at the front and rear axles of a vehicle are also strongly influenced by the brake force distribution between the axles and the thermal balance of the brake system.

Given the nonlinear response of disc brake pad wear to thermal conditions and brake force distribution in a particular vehicle configuration, wear results measured in one vehicle configuration should not be used to predict the wear life in another platform.

The pad thickness at eight locations was averaged for both the inboard and outboard pads. The average thickness change at the inboard and outboard pads was then averaged for the front and rear brake positions separately.

The testing conducted in the 2010 NIJ-MSP replacement brake pad assessment project was not specifically intended to predict wear life in normal vehicle service.

Standard Deviation (St Dev)

Standard deviation is a statistic that indicates how tightly various points of data are clustered around the average. For purposes of this test, standard deviation indicates the consistency by which each set of brake pads performed. Lower standard deviation numbers indicate more consistency in performance during the 60-0 mph and 125-0 mph measured stops.

Average Stopping Distances

Average stopping distances were calculated after the initial speed for each stop was mathematically corrected to 60 mph in Phase 1 and 125 mph in Phase 2 using a V^2 factor for initial velocity. The formula below was used to calculate the corrected stopping distance.

$[(\text{Target initial speed})^2/(\text{Actual initial test speed})^2] \times$ Actual stopping distance.

Thus, the distance for each measured stop can be accurately compared, knowing the initial velocity is the same.

Average Deceleration Rate

The data resulting from the six, 125-0 mph stops was used to calculate the average deceleration rate in feet per second squared (ft per sec^2) and percentage of G-force. Higher deceleration and G-force numbers indicate greater stopping ability.

Driver Evaluations

After each segment of vehicle testing, the driver completed an evaluation containing uniform categories. While data gathered with driver evaluations is considered to be subjective, in numerous cases similar responses from different drivers indicate a trend in performance.

Edge Code

An edge code contains specific information about brake lining, including a manufacturer’s identification, a numeric code that references the lining type, and alpha characters that indicate the initial friction properties of the linings.

Brake Pad Manufacturer, Brand and Edge Codes of Brake Pads Tested

Vehicle	Manufacturer	Brand Name	Edge Code
Dodge Charger	Affinia-BPI	AC Delco	Front: DEL TK-FE Rear: DEL TK-FE
Dodge Charger	O/E		Front: TX4203TA-FF Rear: TX4203TA-FF
Ford CVPI	Affinia-BPI	AC Delco	Front: DEL TK-FE Rear: DEL TK-FE
Ford CVPI	FDP Brakes	MaxStop Plus SM 98 Formulation	Front: FDP-SM98-EE Rear: FDP-SM98-EE
Ford CVPI	Rayloc	Napa Ultra Premium	Front: SD 9008-FF Rear: DMJ 720-FF
Ford CVPI	O/E		Front: TX2014TA-FF Rear: FM2136-FF
Impala	Affinia-BPI	AC Delco	Front: DEL TK-FE Rear: DEL TK-FE
Impala	Fras-Le	Extreme Service-Police	Front: FHT-1P-FF Rear: FHT-1P-FF
Impala	GRI Engineering and Development LLC	Dan Block	Front: K079A Rear: K079A
Impala	O/E		Front: HP1000-1 Rear: AK NS265H-FF
Tahoe	Affinia-BPI	AC Delco	Front: DEL TK-FE Rear: DEL TK-FE
Tahoe	O/E		Front: FER 4245-FF Rear: FM 2258-FF

Brake Pad Tests by Vehicle Platform

Brake Material Manufacturer: Affinia – BPI

Brand: AC/Delco

Subject Material: Part Numbers/Edge Codes

Front: 17D1058MHPV/DEL TK-FE
Rear: 17D1057AMHPV/DEL TK-FE

Also marketed as: part number/edge code

Raybestos: (Front) ATD1058P/POL-ICE-FE, (Rear) ATD1057AP/POL-ICE-FE
UAP-NAPA: (Front) SD7965MP/RCP-POL-FE, (Rear) SD8292MP/RCP-POL-FE
CarQuest: (Front) GPD1058/POL-ICE-FE, (Rear) GPD1057A/POL-ICE-FE

Dodge Charger

Test Vehicle Information		**VIN**
2009 Dodge Charger 5.7L		2B3LA43T29H604215
Weight Front Left 1,144 Right 1,154 Total 2,298	**Weight Rear** Left 1,006 Right 1,020 Total 2,026	**Weight Percentage Front** 53.15%
Total Weight 4,324		**Tire Information** Firestone Firehawk GT Pursuit 225/60 R 18

Subject Material Performance Data

Stopping Distance Averages and Standard Deviations

Stopping Distances Revised Using a V^2 Factor for Initial Velocity

Corrected stopping distance =
[(Target initial speed)²/(Actual initial test speed)²] x Actual stopping distance

Phase 1

Test: First 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
135.48	130.79	134.23	134.23	134.15	137.49	137.38	136.56	138.14	134.88	135.33	2.07

Phase 2

Test: Second 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
132.27	128.56	131.24	131.29	131.89	128.48	134.17	133.20	135.36	133.76	132.02	2.26

Driver Evaluations Following 60-0 MPH Stops

Driver: Sgt. Rogers

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	5
Changes in Activation	1
Pull Side to Side	1
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	3
Noise	1
Roughness Pulsation	2

Ratings: 1=None, 5=Most

Phase 3

Test: Six 125-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Average	St Dev
575.88	559.59	560.60	556.13	555.02	554.25	560.25	8.06

Average Deceleration 30.00 ft/s^2

Average Deceleration 0.932 Gs

Driver Evaluations Following 125-0 MPH Stops

Driver: Sgt. Rogers

Fade	2
Change in Pedal Feel	4
Pedal Travel	2
ABS Activation	2
Changes in Activation	1
Pull Side to Side	2
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	1
Noise	2
Roughness Pulsation	4

Ratings: 1=None, 5=Most

Performance Driving Data
Grattan Raceway

Vehicles	Drivers	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Lap 6	Lap 7	Lap 8	Average
Car #1 Charger	GROMAK	01:37.70	01:37.10	01:38.00	01:38.20	01:37.80	01:37.70	01:38.50	01:39.20	01:38.03
	ROGERS	01:39.10	01:38.60	01:38.60	01:38.50	01:38.90	01:38.40	01:38.60	01:38.60	01:38.66
	MCCARTHY	01:38.60	01:38.50	01:39.00	01:39.20	01:38.90	01:38.90	01:38.80	01:39.00	01:38.86
	FLEGEL	01:39.30	01:39.40	01:39.30	01:40.20	01:39.80	01:40.20	01:40.40	01:40.40	01:39.88
Overall Average										**01:38.86**

This portion of testing shows no appreciable degradation in performance.

Driver Evaluations Following Performance Driving

	Fade	Change in Pedal Feel	Pedal Travel	ABS Activation	Changes in Activation	Pull Side to Side	Consistency of Performance Issues	Under Steer	Over Steer	Odor/Smoke	Noise	Roughness/ Pulsation
Gromak	2	3	3	3	2	1	1	1	2	2	1	1
Flegel	3	1	2	2	1	1	1	1	1	1	1	1
McCarthy	2	2	2	2	1	1	2	1	1	1	1	1
Rogers	3	1	3	1	1	1	1	1	1	1	1	1

Ratings: 1=None, 5=Most

Original Equipment

Subject Material: Edge Codes

Front: TX4203TA-FF
Rear: TX4203TA-FF

Dodge Charger

Test Vehicle Information		VIN
2009 Dodge Charger 5.7L		2B3LA43T39H604224
Weight Front	**Weight Rear**	
Left 1,160 Right 1,139 Total 2,299	Left 983 Right 1,040 Total 2,023	**Weight Percentage Front** 53.19%
Total Weight		**Tire Information**
4,322		Firestone Firehawk GT Pursuit 225/60 R 18

Subject Material Performance Data

Stopping Distance Averages and Standard Deviations

Stopping Distances Revised Using a V^2 Factor for Initial Velocity

Corrected stopping distance =
[(Target initial speed)²/(Actual initial test speed)²] x Actual stopping distance

Phase 1

Test: First 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
142.06	133.79	138.98	133.53	136.06	138.31	135.75	134.41	140.55	132.09	136.55	3.12

Phase 2

Test: Second 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
135.94	132.90	131.27	132.83	129.90	131.57	134.91	129.75	131.84	133.78	132.47	2.02

Driver Evaluations Following 60-0 MPH Stops

Driver: Sgt. Rogers

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	1
Changes in Activation	1
Pull Side to Side	1
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	2
Noise	3
Roughness Pulsation	4

Ratings: 1=None, 5=Most

Phase 3

Test: Six 125-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Average	St Dev
571.30	565.05	562.42	560.34	555.33	551.62	561.01	7.00

Average Deceleration 29.95 ft/s^2

Average Deceleration 0.931 Gs

Driver Evaluations Following 125 MPH-0 Stops

Driver: Sgt. Rogers

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	2
Changes in Activation	1
Pull Side to Side	3
Consistency of Performance Issues	1
Under Steer	1
Over Steer	3
Odor/Smoke	1
Noise	3
Roughness Pulsation	2

Ratings: 1=None, 5=Most

Performance Driving Data
Grattan Raceway

Vehicles	Drivers	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Lap 6	Lap 7	Lap 8	Average
Car #2 TD35 Charger	GROMAK	01:37.40	01:38.00	01:38.00	01:38.20	01:37.90	01:38.10	01:38.60	01:39.10	01:38.16
	ROGERS	01:38.80	01:38.20	01:38.10	01:38.20	01:38.10	01:37.70	01:38.10	01:37.70	01:38.11
	MCCARTHY	01:38.30	01:38.70	01:38.80	01:38.90	01:38.60	01:39.80	01:38.20	01:38.30	01:38.70
	FLEGEL	01:38.20	01:38.40	01:38.10	01:37.70	01:42.30	01:40.30	01:38.80	01:39.40	01:39.15
Overall Average										**01:38.53**

This portion of testing shows no appreciable degradation in performance.

Driver Evaluations Following Performance Driving

	Fade	Change in Pedal Feel	Pedal Travel	ABS Activation	Changes in Activation	Pull Side to Side	Consistency of Performance Issues	Under Steer	Over Steer	Odor/Smoke	Noise	Roughness/ Pulsation
Gromak	1	1	1	1	1	1	1	1	1	1	1	1
Flegel	1	1	1	3	3	1	1	1	1	1	1	1
McCarthy	2	2	2	1	1	1	2	1	1	1	1	2
Rogers	2	2	2	1	1	1	1	1	1	1	1	1

Ratings: 1=None, 5=Most

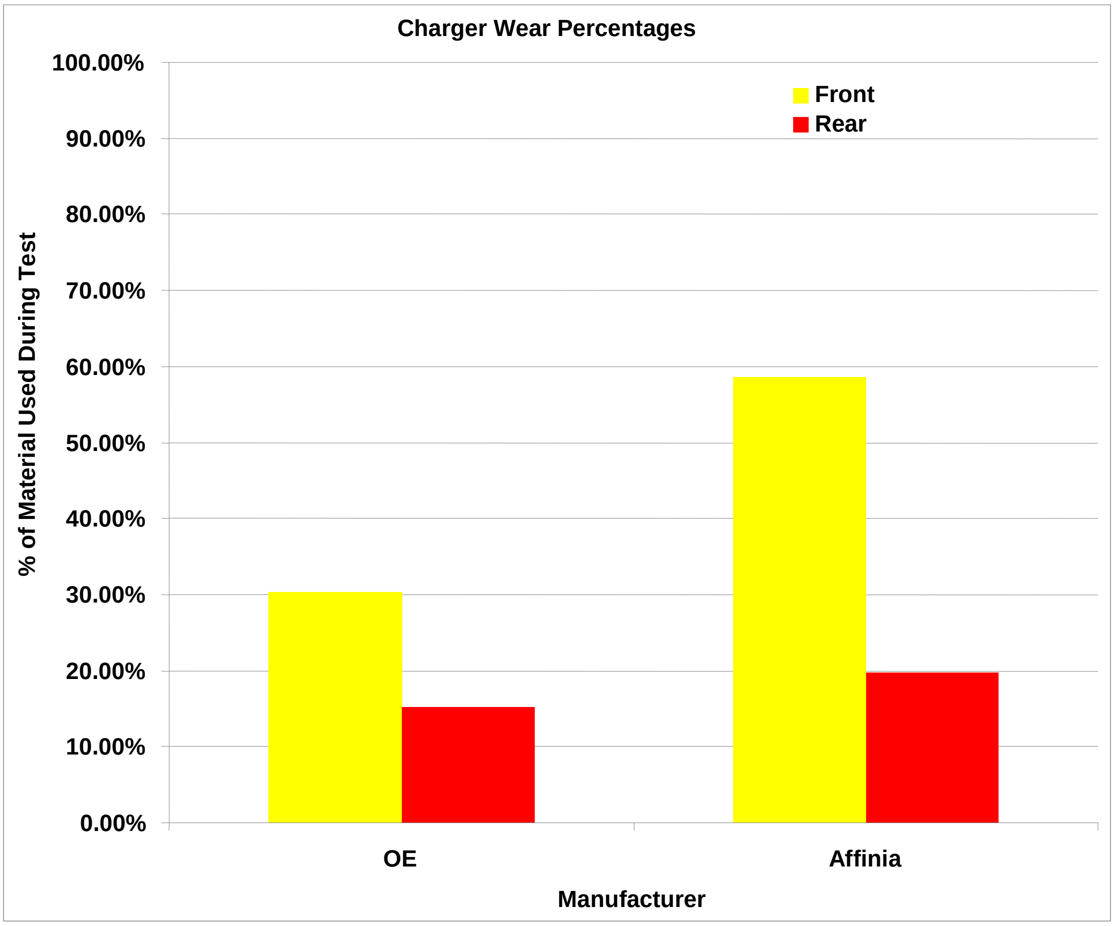
Dodge Charger Wear Data

Percentage of Pad Thickness Consumed During Testing

The percentage of brake pad thickness consumed during vehicle testing of the Dodge Charger platform is summarized in the figure below.

The Affinia DEL TK-FE aftermarket brake friction material was the only replacement product that qualified for vehicle evaluations in the 2010 Dodge Charger platform. Here the percentage of pad thickness consumed during vehicle testing at the front and rear brake positions is shown for the original equipment/original equipment supplier (OE/OES) material and the Affinia DEL TK-FE material.

In this vehicle configuration, vehicle testing consumed almost 60 percent of the available pad thickness of the front brake pads for the Affinia DEL TK-FE material, while the OE/OES brake pads experienced a 30 percent thickness change at this same brake position.



(Please be mindful that the wear figures shown above are not indicative of a normal use lifecycle.)

Brake Material Manufacturer: Affinia – BPI

Brand: AC/Delco

Subject Material: Part Numbers/Edge Codes

Front: 17D931MHPV/DEL TK-FE
Rear: 17D1040AMHPV/DEL TK-FE

Also marketed as: part number/edge code

Raybestos: (Front) ATD931P/POL-ICE-FE, (Rear) ATD1040AP/POL-ICE-FE
UAP-NAPA: (Front) SD7834MP/RCP-POL-FE, (Rear) SD7944AMP/RCP-POL-FE
CarQuest: (Front) GPD931/POL-ICE-FE, (Rear) GPD1040A/POL-ICE-FE

Ford Crown Victoria Police Interceptor

<table>
<tr><td colspan="2">Test Vehicle Information

2009 Ford CVPI</td><td>VIN

2FABP7BV1AX125586</td></tr>
<tr><td>Weight Front

Left 1,163
Right 1,155

Total 2,318</td><td>Weight Rear

Left 915
Right 920

Total 1,835</td><td>Weight Percentage Front

55.82%</td></tr>
<tr><td colspan="2">Total Weight

4153</td><td>Tire Information

Goodyear RS-A
235/55 R17 98W</td></tr>
</table>

Subject Material Performance Data

Stopping Distance Averages and Standard Deviations

Stopping Distances Revised Using a V^2 Factor for Initial Velocity

Corrected stopping distance =
[(Target initial speed)²/(Actual initial test speed)²] x Actual stopping distance

Phase 1

Test: Ten 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
143.51	141.85	144.68	142.79	142.56	142.12	148.00	144.11	150.13	142.72	144.25	2.73

Phase 2

Test: Second 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
142.79	140.72	141.38	139.64	139.94	136.16	140.93	140.31	137.68	144.07	140.36	2.28

Driver Evaluations Following 60-0 MPH Stops

Driver: Sgt. Rogers

Fade	2
Change in Pedal Feel	2
Pedal Travel	2
ABS Activation	2
Changes in Activation	1
Pull Side to Side	2
Consistency of Performance Issues	1
Under Steer	1
Over Steer	3
Odor/Smoke	4
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Phase 3

Test: Six 125-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Average	St Dev
586.93	583.56	575.39	577.51	573.58	566.57	577.26	7.27

Average Deceleration 29.11 ft/s^2
Average Deceleration 0.905 G's

Driver Evaluations Following 125-0 MPH Stops

Driver: Sgt. Rogers

Fade	2
Change in Pedal Feel	2
Pedal Travel	1
ABS Activation	2
Changes in Activation	1
Pull Side to Side	1
Consistency of Performance Issues	1
Under Steer	1
Over Steer	3
Odor/Smoke	1
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Performance Driving Data
Grattan Raceway

Vehicles	Drivers	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Lap 6	Lap 7	Lap 8	Average
Car #3 CVPI	GROMAK	01:41.20	01:41.30	01:41.20	01:41.50	01:41.90	01:42.10	01:41.40	01:41.90	01:41.56
	ROGERS	01:41.20	01:41.10	01:41.00	01:41.40	01:41.10	01:41.20	01:41.80	01:41.30	01:41.26
	MCCARTHY	01:42.80	01:42.90	01:42.40	01:42.80	01:42.10	01:42.60	01:42.40	01:42.10	01:42.51
	FLEGEL	01:42.90	01:41.10	01:41.00	01:41.40	01:41.30	01:41.60	01:41.50	01:42.00	01:41.60
Overall Average										**01:41.73**

This portion of testing shows no appreciable degradation in performance.

Driver Evaluations Following Performance Driving

	Fade	Change in Pedal Feel	Pedal Travel	ABS Activation	Changes in Activation	Pull Side to Side	Consistency of Performance Issues	Under Steer	Over Steer	Odor/Smoke	Noise	Roughness/ Pulsation
Rogers	2	1	1	1	1	1	1	1	1	1	1	1
Gromak	1	1	1	1	1	1	1	1	1	1	1	1
Flegel	1	1	1	1	1	1	1	1	1	1	1	1
McCarthy	1	1	2	1	1	1	5	1	1	2	1	2

Ratings: 1=None, 5=Most

Brake Material Manufacturer: FDP Brakes

Brand: MaxStop Plus SM 98 Formulation

Subject Material: Part Numbers/Edge Codes

Front: MD931/FDP-SM98-EE
Rear: MD932/FDP-SM98-EE

Ford Crown Victoria Police Interceptor

<table>
<tr><td colspan="2">Test Vehicle Information

2009 Ford CVPI</td><td>VIN

2FABP7BV3AX125587</td></tr>
<tr><td>Weight Front

Left 1,156
Right 1,158

Total 2,314</td><td>Weight Rear

Left 921
Right 917

Total 1,838</td><td>Weight Percentage Front

55.73%</td></tr>
<tr><td colspan="2">Total Weight

4,152</td><td>Tire Information

Goodyear RS-A
235/55 R17 98W</td></tr>
</table>

Subject Material Performance Data

Stopping Distance Averages and Standard Deviations

Stopping Distances Revised Using a V^2 Factor for Initial Velocity

Corrected stopping distance =
[(Target initial speed)^2/(Actual initial test speed)^2] x Actual stopping distance

Phase 1

Test: First 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
148.44	152.11	156.72	167.82	173.86	180.55	189.19	198.23	195.53	193.68	175.61	18.72

Phase 2

Test: Second 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
147.25	142.56	144.05	147.08	146.83	147.72	150.16	155.02	162.14	165.73	150.85	7.71

Driver Evaluations Following 60-0 MPH Stops

Driver: Sgt. Rogers

Fade	5
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	2
Changes in Activation	2
Pull Side to Side	3
Consistency of Performance Issues	5
Under Steer	1
Over Steer	4
Odor/Smoke	5
Noise	2
Roughness Pulsation	2

Ratings: 1=None, 5=Most

Phase 3

Test: Six 125-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Average	St Dev
614.70	618.06	613.75	637.73	654.96	674.59	635.63	24.99

Average Deceleration 26.44 ft/s^2

Average Deceleration 0.882 G's

Driver Evaluations Following 125-0 MPH Stops

Driver: Sgt. Rogers

Fade	5
Change in Pedal Feel	3
Pedal Travel	2
ABS Activation	4
Changes in Activation	3
Pull Side to Side	4
Consistency of Performance Issues	5
Under Steer	1
Over Steer	5
Odor/Smoke	4
Noise	2
Roughness Pulsation	2

Ratings: 1=None, 5=Most

Performance Driving Data
Grattan Raceway

Vehicles	Drivers	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Lap 6	Lap 7	Lap 8	Average
Car #4 CVPI	GROMAK	01:40.70	01:40.50	01:40.60	01:41.00	01:41.00	01:41.50	01:41.10	01:41.50	01:40.99
	ROGERS	01:41.10	01:41.30	01:41.20	01:41.20	01:41.30	01:42.00	01:41.20	01:41.80	01:41.39
	MCCARTHY	01:41.90	01:42.20	01:42.30	01:42.00	01:41.70	01:42.00	01:41.80	01:42.10	01:42.00
	FLEGEL	01:41.20	01:41.00	01:40.90	01:40.80	01:41.30	01:40.90	01:41.30	01:41.00	01:41.05
Overall Average										**01:41.36**

This portion of testing shows no appreciable degradation in performance.

Driver Evaluations Following Performance Driving

	Fade	Change in Pedal Feel	Pedal Travel	ABS Activation	Changes in Activation	Pull Side to Side	Consistency of Performance Issues	Under Steer	Over Steer	Odor/Smoke	Noise	Roughness/ Pulsation
Flegel	1	1	1	1	1	1	1	1	1	1	1	1
McCarthy	2	2	2	1	2	1	2	1	1	1	1	1
Rogers	2	2	1	1	1	1	1	1	1	1	4	4
Gromak	1	1	1	1	1	1	1	1	1	1	1	1

Ratings: 1=None, 5=Most

Brake Material Manufacturer: Rayloc

Brand: Napa Ultra Premium

Subject Material: Part Numbers/Edge Codes

Front: UP-7834-SD/SD 9008-FF
Rear: UP-7834-SD/DMJ 720-FF

Ford Crown Victoria Police Interceptor

<table>
<tr><td colspan="2">Test Vehicle Information

2009 Ford CVPI</td><td>VIN

2FABP7BV8AX125584</td></tr>
<tr><td>Weight Front

Left 1,164
Right 1,154

Total 2,318</td><td>Weight Rear

Left 916
Right 923

Total 1,839</td><td>Weight Percentage Front

55.76%</td></tr>
<tr><td colspan="2">Total Weight

4,157</td><td>Tire Information

Goodyear RS-A
235/55 R17 98W</td></tr>
</table>

Subject Material Performance Data

Stopping Distance Averages and Standard Deviations

Stopping Distances Revised Using a V^2 Factor for Initial Velocity

Corrected stopping distance =
[(Target initial speed)²/(Actual initial test speed)²] x Actual stopping distance

Phase 1

Test: First 10 60-0 mph impending skid (ABS) maximum deceleration rate stops.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
143.80	143.91	132.40	145.43	144.03	140.74	147.12	141.22	146.00	148.37	143.30	4.51

Phase 2

Test: Second 10 60-0 mph impending skid (ABS) maximum deceleration rate stops.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
143.21	140.27	138.72	138.07	142.43	137.80	137.18	138.89	139.82	134.83	139.12	2.47

Driver Evaluations Following 60-0 MPH Stops

Driver: Sgt. Rogers

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	1
Changes in Activation	1
Pull Side to Side	1
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	3
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Phase 3

Test: Six 125-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Average	St Dev
588.34	580.95	584.51	548.89	562.52	570.40	572.60	15.02

Average Deceleration 29.35 ft/s^2

Average Deceleration 0.912 Gs

Driver Evaluations Following 125-0 MPH Stops

Driver: Sgt. Rogers

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	1
Changes in Activation	1
Pull Side to Side	5
Consistency of Performance Issues	1
Under Steer	1
Over Steer	2
Odor/Smoke	2
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Performance Driving Data
Grattan Raceway

Vehicles	Drivers	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Lap 6	Lap 7	Lap 8	Average
Car #5 TD23 CVPI	GROMAK	01:41.00	01:40.70	01:41.00	01:40.90	01:40.60	01:41.00	01:40.90	01:41.10	01:40.90
	ROGERS	01:41.10	01:40.60	01:40.80	01:40.50	01:40.80	01:40.50	01:40.70	01:40.70	01:40.71
	MCCARTHY	01:42.70	01:42.80	01:42.10	01:41.80	01:42.50	01:42.30	01:42.10	01:42.40	01:42.34
	FLEGEL	01:41.10	01:41.20	01:41.30	01:40.80	01:41.10	01:41.40	01:41.50	01:42.10	01:41.31
Overall Average										**01:41.32**

This portion of testing shows no appreciable degradation in performance.

Driver Evaluations Following Performance Driving

	Fade	Change in Pedal Feel	Pedal Travel	ABS Activation	Changes in Activation	Pull Side to Side	Consistency of Performance Issues	Under Steer	Over Steer	Odor/smoke	Noise	Roughness/ Pulsation
Gromak	1	1	1	1	1	1	1	1	1	1	1	1
Flegel	1	1	1	1	1	1	1	1	1	1	1	1
McCarthy	1	1	1	1	1	1	1	1	1	1	1	1
Rogers	1	1	1	1	1	1	1	1	1	1	1	1

Ratings: 1=None, 5=Most

Original Equipment

Subject Material: Edge Codes

Front: TX2014TA-FF
Rear: FM2136-FF

Ford Crown Victoria Police Interceptor

<table>
<tr><td colspan="2">Test Vehicle Information

2009 Ford CVPI</td><td>VIN

2FABP7BV5AX125588</td></tr>
<tr><td>Weight Front

Left 1,158
Right 1,161

Total 2,319</td><td>Weight Rear

Left 920
Right 915

Total 1,835</td><td>Weight Percentage Front

55.83%</td></tr>
<tr><td colspan="2">Total Weight

4,154</td><td>Tire Information

Goodyear RS-A
235/55 R17 98W</td></tr>
</table>

Subject Material Performance Data

Stopping Distance Averages and Standard Deviations

Stopping Distances Revised Using a V^2 Factor for Initial Velocity

Corrected stopping distance =
[(Target initial speed)^2/(Actual initial test speed)^2] x Actual stopping distance

Phase 1

Test: First 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
147.22	140.08	145.77	145.69	143.20	143.59	142.54	143.01	145.21	147.15	144.35	2.26

Phase 2

Test: Second 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
144.20	138.91	141.20	142.33	141.02	138.65	142.36	143.90	134.87	139.83	140.73	2.80

Driver Evaluations Following 60-0 MPH Stops

Driver: Sgt. Rogers

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	4
Changes in Activation	4
Pull Side to Side	1
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	4
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Phase 3

Test: Six 125-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Average	St Dev
597.35	601.44	590.69	573.54	581.50	576.88	586.90	11.34

Average Deceleration 28.63 ft/s^2

Average Deceleration 0.890 G's

Driver Evaluations Following 125-0 MPH Stops

Driver: Sgt. Rogers

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	2
Changes in Activation	3
Pull Side to Side	1
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	2
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Performance Driving Data
Grattan Raceway

Vehicles	Drivers	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Lap 6	Lap 7	Lap 8	Average
Car #6 CVPI	GROMAK	01:40.90	01:41.00	01:40.90	01:40.90	01:41.50	01:41.20	01:41.50	01:40.70	01:41.07
	ROGERS	01:42.00	01:41.60	01:41.20	01:41.80	01:41.10	01:41.10	01:41.40	01:41.40	01:41.45
	MCCARTHY	01:41.70	01:42.60	01:41.90	01:42.50	01:42.30	01:42.20	01:42.40	01:42.70	01:42.29
	FLEGEL	01:41.20	01:40.70	01:40.60	01:40.60	01:41.10	01:41.00	01:41.40	01:42.00	01:41.08
Overall Average										**01:41.47**

This portion of testing shows no appreciable degradation in performance.

Driver Evaluations Following Performance Driving

	Fade	Change in Pedal Feel	Pedal Travel	ABS Activation	Changes in Activation	Pull Side to Side	Consistency of Performance Issues	Under Steer	Over Steer	Odor/smoke	Noise	Roughness/ Pulsation
Rogers	2	1	3	1	1	1	1	1	1	3	1	1
Gromak	1	1	1	1	1	1	1	1	1	1	1	1
Flegel	1	1	1	1	1	1	1	1	1	1	1	1
McCarthy	1	2	1	1	1	1	1	1	1	2	1	2

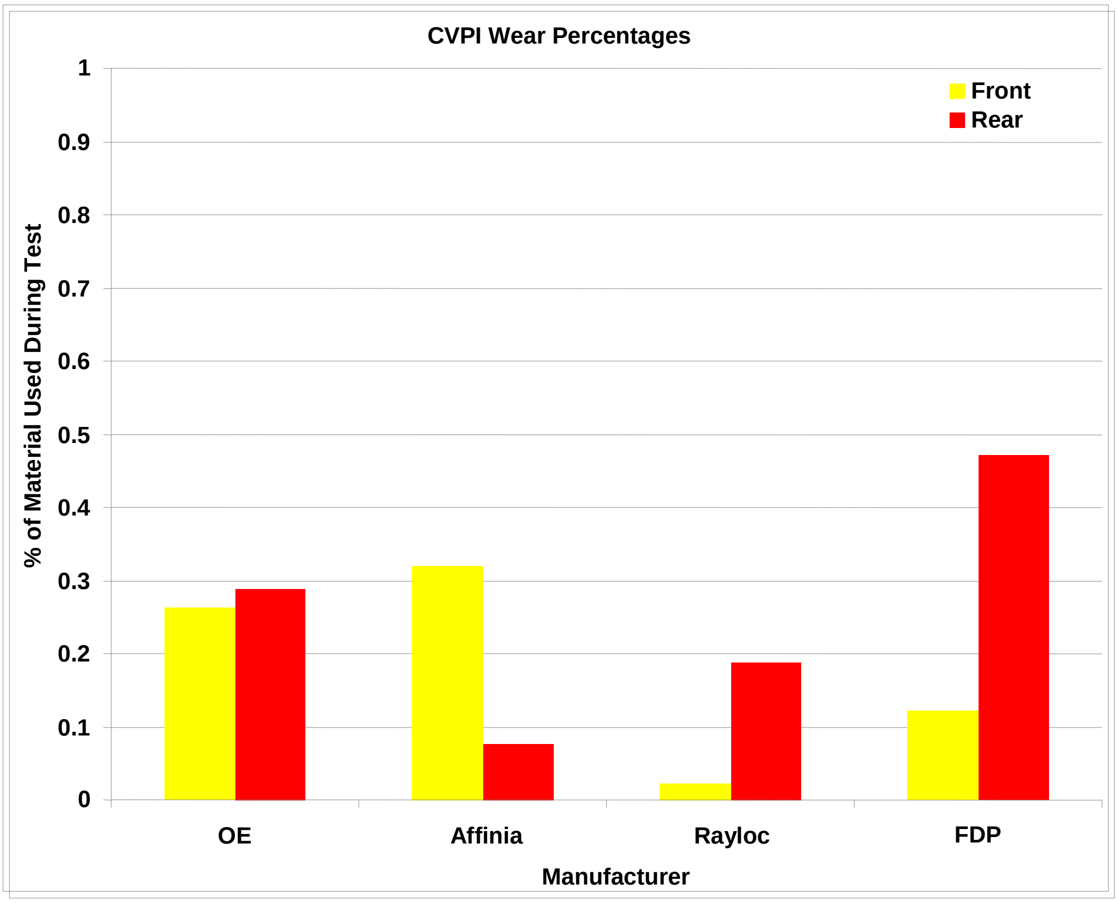
Ratings: 1=None, 5=Most

Ford Crown Victoria Police Interceptor Wear Data

Percentage of Pad Thickness Consumed During Testing

The 2010 Ford CVPI platform had three aftermarket brake friction materials that qualified for vehicle testing at Chelsea and Grattan: the Affinia DEL TK-FE, the Rayloc SD9008-FF/DMJ 720-FF, and the FDP-SM98-EE edge code products. The percentage of available pad thickness consumed in vehicle testing for these three aftermarket products and the OE/OES control sample are shown, by brake position, in the figure below.

In this case, the Rayloc aftermarket brake friction materials experienced less wear than the OE/OES product in this particular vehicle test sequence. The Affinia brake pads for this vehicle configuration produced comparable wear at the front brake, but significantly less wear at the rear when compared to the OE control sample. These disparate wear results at the front and rear brake positions are undoubtedly related in a complex way with the underlying brake force distribution and operating temperatures (thermal balance) of this vehicle fitted with these aftermarket materials. The OE control sample produced the best overall wear balance (front/rear) of the samples evalauted.



(Please be mindful the wear figures shown above are not indicative of a normal use lifecycle.)

Brake Material Manufacturer: Affinia – BPI

Brand: AC/Delco

Subject Material: Part Numbers/Edge Codes

Front: 17D1159MHPV/DEL TK-FE
Rear: 17D698MHPV/DEL TK-FE

Also marketed as: part number/edge code

Raybestos: (Front) ATD1159P/POL-ICE-FE, (Rear) ATD698P/POL-ICE-FE
UAP-NAPA: (Front) SD8269MP/RCP-POL-FE, (Rear) SD7387AMP/RCP-POL-FE
CarQuest: (Front) GPD1159/POL-ICE-FE, (Rear) GPD698/POL-ICE-FE

Chevrolet Impala 9C1

<table>
<tr><td colspan="2">Test Vehicle Information

2010 Chevrolet Impala 9 C1</td><td>VIN

2G1WD5EMXA100001</td></tr>
<tr><td>Weight Front

Left 1,150
Right 1,142

Total 2,292</td><td>Weight Rear

Left 654
Right 699

Total 1,353</td><td>Weight Percentage Front

62.88%</td></tr>
<tr><td colspan="2">Total Weight

3,645</td><td>Tire Information

Pirelli P6
225/60 R16 97V</td></tr>
</table>

Subject Material Performance Data

Stopping Distance Averages and Standard Deviations

Stopping Distances Revised Using a V^2 Factor for Initial Velocity

Corrected stopping distance =
[(Target initial speed)^2/(Actual initial test speed)^2] x Actual stopping distance

Phase 1

Test: First 10 60-0 mph impending skid (ABS) maximum deceleration rate stops.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
138.07	138.29	137.62	138.14	138.19	139.01	141.35	140.29	135.05	138.58	138.46	1.66

Phase 2

Test: Second 10 60-0 mph impending skid (ABS) maximum deceleration rate stops.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
134.87	136.30	136.84	134.15	135.40	137.14	138.08	137.76	138.03	137.83	136.64	1.41

Driver Evaluations Following 60-0 MPH Stops

Driver: Sgt. Flegel

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	1
Changes in Activation	1
Pull Side to Side	1
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	2
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Phase 3

Test: Six 125-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Average	St Dev
571.87	566.86	580.16	583.24	580.41	578.56	576.85	6.20

Average Deceleration 29.13 ft/s^2

Average Deceleration 0.905 Gs

Driver Evaluations Following 125-0 MPH Stops

Driver: Sgt. Rogers

Fade	1
Change in Pedal Feel	3
Pedal Travel	1
ABS Activation	1
Changes in Activation	1
Pull Side to Side	1
Consistency of Performance Issues	1
Under Steer	1
Over Steer	2
Odor/Smoke	1
Noise	1
Roughness Pulsation	3

Ratings: 1=None, 5=Most

Performance Driving Data
Grattan Raceway

Vehicles	Drivers	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Lap 6	Lap 7	Lap 8	Average
Car #7 Impala	GROMAK	01:42.50	01:45.90	01:44.10	01:43.90	01:43.30	01:42.90	01:44.10	01:43.10	01:43.72
	ROGERS	01:41.90	01:41.90	01:42.50	01:42.50	01:43.20	01:42.70	01:42.70	01:42.70	01:42.51
	MCCARTHY	01:42.80	01:43.30	01:43.60	01:43.90	01:43.50	01:43.30	01:44.10	01:44.20	01:43.59
	FLEGEL	01:42.50	01:42.80	01:43.50	01:43.00	01:43.00	01:43.30	01:42.80	01:42.90	01:42.97
Overall Average										**01:43.20**

This portion of testing shows no appreciable degradation in performance.

Driver Evaluations Following Performance Driving

	Fade	Change in Pedal Feel	Pedal Travel	ABS Activation	Changes in Activation	Pull Side to Side	Consistency of Performance Issues	Under Steer	Over Steer	Odor/Smoke	Noise	Roughness/ Pulsation
McCarthy	3	3	4	2	2	1	3	1	1	1	1	2
Rogers	3	4	4	3	4	1	3	1	4	1	1	2
Gromak	4	4	4	2	1	1	3	1	1	1	1	1
Flegel	2	1	2	2	2	1	1	1	1	1	4	1

Ratings: 1=None, 5=Most

Brake Material Manufacturer: Fras-Le

Brand: Extreme Service-Police

Subject Material: Part Numbers/Edge Codes

Front: ESD1159/FHT-1P-FF
Rear: ESD814/FHT-1P-FF

Chevrolet Impala 9C1

<table>
<tr><td colspan="2">Test Vehicle Information

2010 Chevrolet Impala 9 C1</td><td>VIN

2G1WD5EMZA1105712</td></tr>
<tr><td>Weight Front

Left 1,151
Right 1,146

Total 2,297</td><td>Weight Rear

Left 660
Right 697

Total 1,357</td><td>Weight Percentage Front

62.86%</td></tr>
<tr><td colspan="2">Total Weight

3,654</td><td>Tire Information

Pirelli P6
225/60 R16 97V</td></tr>
</table>

Subject Material Performance Data

Stopping Distance Averages and Standard Deviations

Stopping Distances Revised Using a V^2 Factor for Initial Velocity

Corrected stopping distance =
[(Target initial speed)^2/(Actual initial test speed)^2] x Actual stopping distance

Phase 1

Test: First 10 60-0 mph impending skid (ABS) maximum deceleration rate stops.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
144.88	146.70	147.73	145.44	145.16	142.06	140.51	141.66	141.52	145.26	144.09	2.46

Phase 2

Test: Second 10 60-0 mph impending skid (ABS) maximum deceleration rate stops.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
142.82	138.91	141.76	143.30	141.47	143.66	143.34	142.57	144.91	142.79	142.55	1.60

Driver Evaluations Following 60-0 MPH Stops

Driver: Sgt. Flegel

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	1
Changes in Activation	1
Pull Side to Side	3
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	1
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Phase 3

Test: Six 125-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Average	St Dev
615.68	623.13	603.66	604.90	600.72	601.97	608.34	9.00

Average Deceleration 27.62 ft/s^2

Average Deceleration 0.859 Gs

Driver Evaluations Following 125-0 MPH Stops

Driver: Sgt. Flegel

Fade	1
Change in Pedal Feel	3
Pedal Travel	2
ABS Activation	1
Changes in Activation	1
Pull Side to Side	1
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	2
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Performance Driving Data
Grattan Raceway

Vehicles	Drivers	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Lap 6	Lap 7	Lap 8	Average
Car #8 Impala	GROMAK									
	ROGERS									
	MCCARTHY	01:43.40	01:44.00	01:44.00	01:44.30	01:44.30	01:45.10	01:44.10	01:44.30	01:44.19
	FLEGEL	01:42.90	01:42.70	01:43.80	01:43.20	01:43.00	01:43.30	01:43.10	01:43.00	01:43.13
Overall Average										**01:43.66**

Impala, Car #8 was suspended from testing. Drivers detected problems with the brakes. An inspection revealed a very small amount of friction material remained on the front brake pads after two series of laps.

Driver Evaluations Following Performance Driving

	Fade	Change in Pedal Feel	Pedal Travel	ABS Activation	Changes in Activation	Pull Side to Side	Consistency of Performance Issues	Under Steer	Over Steer	Odor/Smoke	Noise	Roughness/ Pulsation
Flegel	1	1	1	1	1	1	1	1	1	1	1	1
McCarty	2	3	3	1	2	2	3	1	1	1	1	1
Suspended												
Suspended												

Ratings: 1=None, 5=Most

Brake Material Manufacturer: GRI Engineering & Development LLC

Brand: Dan-Block

Subject Material: Part Numbers/Edge Codes

Front: D1159/K079A
Rear: D814/K079A

Chevrolet Impala 9C1

<table>
<tr><td colspan="2">Test Vehicle Information

2010 Chevrolet Impala 9 C1</td><td>VIN

2G1WD5EM4A1105713</td></tr>
<tr><td>Weight Front

Left 1,141
Right 1,152

Total 2,293</td><td>Weight Rear

Left 662
Right 691

Total 1,353</td><td>Weight Percentage Front

62.89%</td></tr>
<tr><td colspan="2">Total Weight

3,646</td><td>Tire Information

Pirelli P6
225/60 R16 97V</td></tr>
</table>

Subject Material Performance Data

Stopping Distance Averages and Standard Deviations

Stopping Distances Revised Using a V^2 Factor for Initial Velocity

Corrected stopping distance =
[(Target initial speed)^2/(Actual initial test speed)^2] x Actual stopping distance

Phase 1

Test: First 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
137.22	137.27	140.42	140.56	142.91	141.01	138.97	139.41	137.86	143.37	139.90	2.17

Phase 2

Test: Second 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in meet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
139.79	138.53	138.46	136.11	137.89	143.40	140.63	137.43	139.15	140.98	139.24	2.07

Driver Evaluations Following 60-0 MPH Stops

Driver: Sgt. Flegel

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	1
Changes in Activation	1
Pull Side to Side	1
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	1
Noise	1
Roughness Pulsation	3

Ratings: 1=None, 5=Most

Phase 3

Test: Six 125-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Average	St Dev
600.36	597.09	587.82	599.05	595.31	578.46	593.02	8.38

Average Deceleration 28.34 ft/s^2

Average Deceleration 0.881 Gs

Driver Evaluations Following 125-0 MPH Stops

Driver: Sgt. Flegel

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	1
Changes in Activation	1
Pull Side to Side	4
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	1
Noise	1
Roughness Pulsation	4

Ratings: 1=None, 5=Most

Performance Driving Data
Grattan Raceway

Vehicles	Drivers	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Lap 6	Lap 7	Lap 8	Average
Car #9 Impala	GROMAK	01:42.50	01:42.60	01:41.90	01:42.30	01:42.20	01:42.70	01:42.70	01:42.50	01:42.42
	ROGERS	01:42.60	01:42.90	01:43.10	01:43.30	01:42.80	01:42.90	01:42.70	01:43.20	01:42.94
	MCCARTHY	01:43.10	01:43.60	01:43.90	01:43.50	01:43.60	01:43.70	01:43.70	01:43.80	01:43.61
	FLEGEL	01:42.60	01:42.50	01:42.60	01:43.90	01:43.40	01:43.70	01:43.20	01:43.40	01:43.16
Overall Average										**01:43.03**

This portion of testing shows no appreciable degradation in performance.

Driver Evaluations Following Performance Driving

	Fade	Change in Pedal Feel	Pedal Travel	ABS Activation	Changes in Activation	Pull Side to Side	Consistency of Performance Issues	Under Steer	Over Steer	Odor/Smoke	Noise	Roughness/ Pulsation
Gromak	1	1	1	2	1	1	1	1	3	1	1	1
Flegel	1	1	1	1	1	1	1	1	1	1	1	1
McCarthy	2	1	2	2	1	2	2	1	1	1	1	1
Rogers	3	1	1	1	1	1	2	1	4	1	1	3

Ratings: 1=None, 5=Most

Original Equipment

Subject Material: Edge Codes

Front: HP1000-1
Rear: AK NS265H-FF

Chevrolet Impala 9C1

Test Vehicle Information		VIN
2009 Chevrolet Impala 9 C1		2G1WS57M091100037
Weight Front	**Weight Rear**	
Left 1,139 Right 1,145 Total 2,284	Left 658 Right 685 Total 1,343	**Weight Percentage Front** 62.97%
Total Weight		**Tire Information**
3,627		Pirelli P6 225/60 R16 97V

Subject Material Performance Data

Stopping Distance Averages and Standard Deviations

Stopping Distances Revised Using a V^2 Factor for Initial Velocity

Corrected stopping distance =
[(Target initial speed)^2/(Actual initial test speed)^2] x Actual stopping distance

Phase 1

Test: First 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
141.21	140.70	137.69	140.81	139.49	143.50	142.43	142.66	141.80	144.38	141.47	1.95

Phase 2

Test: Second 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
140.57	137.13	136.76	139.22	138.82	138.45	138.98	139.77	139.32	142.43	139.15	1.62

Driver Evaluations Following 60-0 MPH Stops

Driver: Sgt. Flegel

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	1
Changes in Activation	1
Pull Side to Side	1
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	1
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Phase 3

Test: Six 125-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Average	St Dev
606.85	597.66	596.74	597.40	597.64	597.86	599.03	3.85

Average Deceleration 28.05 ft/s^2

Average Deceleration 0.872 Gs

Driver Evaluations Following 125-0 MPH Stops

Driver: Sgt. Flegel

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	1
Changes in Activation	1
Pull Side to Side	1
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	1
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Performance Driving Data
Grattan Raceway

Vehicles	Drivers	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Lap 6	Lap 7	Lap 8	Average
Car #9 Impala	GROMAK	01:42.60	01:43.00	01:42.80	01:42.90	01:42.70	01:42.40	01:42.50	01:42.90	01:42.72
	ROGERS	01:42.30	01:41.60	01:42.00	01:41.90	01:41.70	01:42.00	01:41.90	01:42.10	01:41.94
	MCCARTHY	01:43.00	01:43.10	01:43.50	01:42.90	01:43.00	01:43.10	01:43.10	01:42.70	01:43.05
	FLEGEL	01:42.20	01:42.70	01:42.40	01:42.70	01:43.30	01:43.10	01:43.00	01:42.90	01:42.79
Overall Average										**01:42.62**

This portion of testing shows no appreciable degradation in performance.

Driver Evaluations Following Performance Driving

	Fade	Change in Pedal Feel	Pedal Travel	ABS Activation	Changes in Activation	Pull Side to Side	Consistency of Performance Issues	Under Steer	Over Steer	Odor/Smoke	Noise	Roughness/ Pulsation
Rogers	1	1	1	4	4	1	1	1	4	1	1	1
Gromak	1	1	3	1	1	1	1	1	1	1	1	3
Flegel	1	1	1	1	1	1	1	1	1	1	1	1
McCarthy	3	3	2	2	1	1	1	1	1	1	1	3

Ratings: 1=None, 5=Most

Chevrolet Impala 9C1 Wear Data

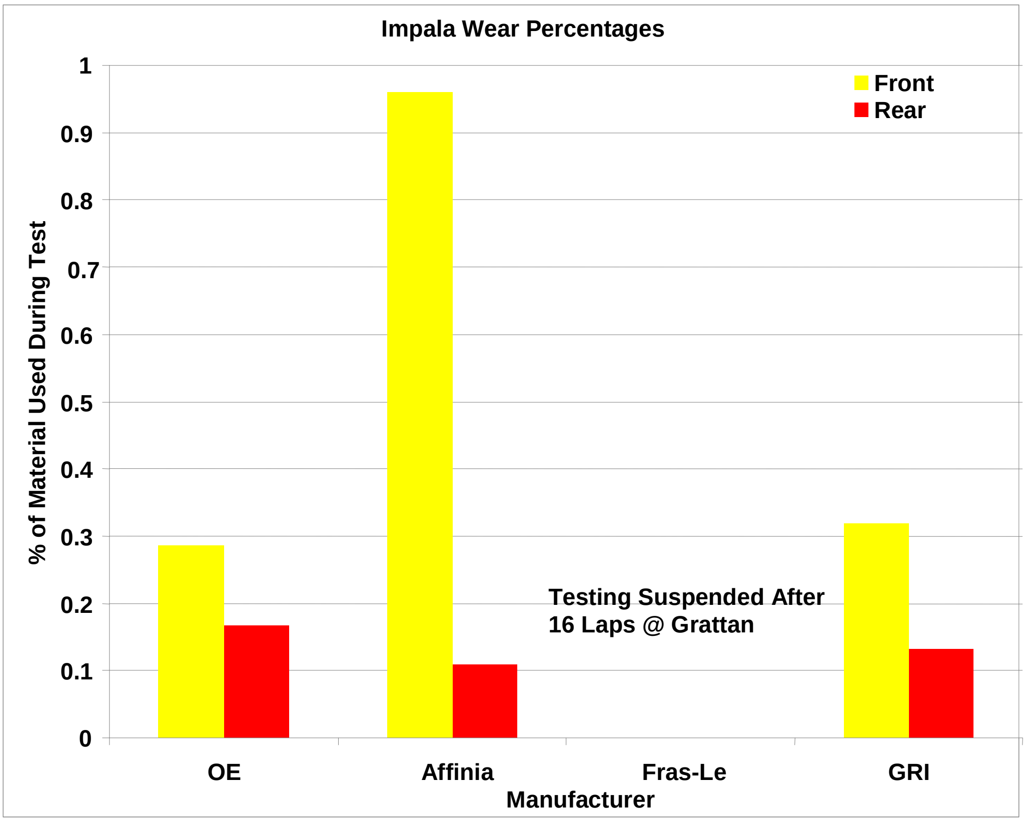
Percentage of Pad Thickness Consumed During Testing

Three aftermarket brake friction products qualified for vehicle evaluations in the 2010 Chevrolet Impala platform. These included the Affinia DEL TK-FE material, the Fras-Le FHT 1P-FF material, and the GRI K079A/K080A brake pad set. These three aftermarket brake friction materials were evaluated along with an OE/OES control sample.

The percentage of available pad thickness consumed in the vehicle test sequence described above for each of the materials tested in the Chevrolet Impala are shown in the figure below at each brake position. The vehicle testing of the Fras-Le aftermarket material was suspended after 16 laps at Grattan due to high pad wear at the front brake.

The Affinia aftermarket material completed all 32 laps of testing at Grattan but showed significant wear at the front brake position while producing only moderate wear at the rear brake position of the same vehicle. This significant difference in wear at the front and rear brake positions of the Impala suggest the underlying thermal and wear balance of this particular vehicle-material combination is not well suited to the specific test sequence used in this study.

The GRI aftermarket material produced similar wear to that measured for the OE/OES material control sample in this vehicle platform.



(Please be mindful the wear figures shown above are not indicative of a normal use lifecycle.)

Brake Material Manufacturer: Affinia – BPI

Brand: AC/Delco

Subject Material: Part Numbers/Edge Codes

Front: 17D1367MHPV/DEL TK-FE
Rear: 17D1194MHPV/DEL TK-FE

Also marketed as: part number/edge code

Raybestos: (Front) ATD1367P/POL-ICE-FE, (Rear) ATD1194P/POL-ICE-FE
UAP-NAPA: (Front) SD8472AMP/RCP-POL-FE, (Rear) SD8312MP/RCP-POL-FE
CarQuest: (Front) GPD1367/POL-ICE-FE, (Rear) GPD1194/POL-ICE-FE

Chevrolet Tahoe 9C1

<table>
<tr><td colspan="2">Test Vehicle Information

2010 Chevrolet Tahoe PPV</td><td>VIN

1GNMCAE05AR245937</td></tr>
<tr><td>Weight Front

Left 1,392
Right 1,413

Total 2,805</td><td>Weight Rear

Left 1,305
Right 1,206

Total 2,511</td><td>Weight Percentage Front

52.77%</td></tr>
<tr><td colspan="2">Total Weight

5,316</td><td>Tire Information

Goodyear RSA
265/60 R17 108H</td></tr>
</table>

Subject Material Performance Data

Stopping Distance Averages and Standard Deviations

Stopping Distances Revised Using a V^2 Factor for Initial Velocity

Corrected stopping distance =
[(Target initial speed)^2/(Actual initial test speed)^2] x Actual stopping distance

Phase 1

Test: First 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
154.47	146.53	151.98	151.20	151.39	147.75	151.50	153.46	162.99	160.39	153.17	5.11

Phase 2

Test: Second 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
148.13	142.37	140.33	145.34	142.73	142.72	144.27	149.81	154.67	156.78	146.72	5.53

Driver Evaluations Following 60-0 MPH Stops

Driver: Sgt. Flegel

Fade	4
Change in Pedal Feel	4
Pedal Travel	2
ABS Activation	3
Changes in Activation	1
Pull Side to Side	1
Consistency of Performance Issues	2
Under Steer	1
Over Steer	1
Odor/Smoke	2
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Phase 3

Test: Six 125-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Average	St Dev
596.26	577.00	570.64	579.30	572.32	564.22	576.62	10.96

Average Deceleration 29.14 ft/s^2

Average Deceleration 0.906 Gs

Driver Evaluations Following 125-0 MPH Stops

Driver: Sgt. Flegel

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	1
Changes in Activation	1
Pull Side to Side	1
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	1
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Performance Driving Data
Grattan Raceway

Vehicles	Drivers	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Lap 6	Lap 7	Lap 8	Average
Car #11 Tahoe	GROMAK	01:42.30	01:41.60	01:42.20	01:42.30	01:42.00	01:42.70	01:46.20	01:42.40	01:42.71
	ROGERS	01:42.80	01:42.00	01:42.20	01:42.50	01:42.20	01:42.30	01:42.60	01:42.70	01:42.41
	MCCARTHY	01:43.60	01:43.70	01:43.00	01:43.00	01:43.20	01:43.40	01:43.00	01:43.00	01:43.24
	FLEGEL	01:43.20	01:42.00	01:41.80	01:43.00	01:42.50	01:42.00	01:42.40	01:42.80	01:42.46
Overall Average										**01:42.71**

This portion of testing shows no appreciable degradation in performance.

Driver Evaluations Following Performance Driving

	Fade	Change in Pedal Feel	Pedal Travel	ABS Activation	Changes in Activation	Pull Side to Side	Consistency of Performance Issues	Under Steer	Over Steer	Odor/smoke	Noise	Roughness/ Pulsation
McCarthy	2	2	2	1	1	1	3	2	1	1	1	1
Rogers	2	1	1	1	1	1	1	1	1	1	1	1
Gromak	1	1	1	1	1	1	1	1	1	1	1	1
Flegel	2	1	1	2	1	1	1	1	1	1	3	1

Ratings: 1=None, 5=Most

Original Equipment

Subject Material: Edge Codes

Front: FER 4245-FF
Rear: FM 2258-FF

Chevrolet Tahoe 9C1

<table>
<tr><td colspan="2">Test Vehicle Information

2010 Chevrolet Tahoe PPV</td><td>VIN

1GNMCAE04AR246576</td></tr>
<tr><td>Weight Front

Left 1,430
Right 1,380

Total 2,810</td><td>Weight Rear

Left 1,276
Right 1,235

Total 2,511</td><td>Weight Percentage Front

52.81%</td></tr>
<tr><td colspan="2">Total Weight

5,321</td><td>Tire Information

Goodyear RSA
265/60 R17 108H</td></tr>
</table>

Subject Material Performance Data

Stopping Distance Averages and Standard Deviations

Stopping Distances Revised Using a V^2 Factor for Initial Velocity

Corrected stopping distance =
[(Target initial speed)^2/(Actual initial test speed)^2] x Actual stopping distance

Phase 1

Test: First 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
139.89	135.78	138.66	138.19	144.62	156.47	165.20	166.62	159.64	149.49	149.46	11.74

Phase 2

Test: Second 10 60-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Stop #7	Stop #8	Stop #9	Stop #10	Average	St Dev
135.69	138.54	135.47	138.41	137.52	137.90	138.66	137.54	138.28	140.29	137.83	1.42

Driver Evaluations Following 60-0 MPH Stops

Driver: Sgt. Flegel

Fade	4
Change in Pedal Feel	4
Pedal Travel	4
ABS Activation	3
Changes in Activation	3
Pull Side to Side	3
Consistency of Performance Issues	4
Under Steer	1
Over Steer	1
Odor/Smoke	3
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Phase 3

Test: Six 125-0 mph impending skid (ABS) maximum deceleration rate stops measured in feet.

Stop #1	Stop #2	Stop #3	Stop #4	Stop #5	Stop #6	Average	St Dev
556.59	552.54	559.96	557.48	560.45	559.69	557.79	2.98

Average Deceleration 30.13 ft/s^2

Average Deceleration 0.936 Gs

Driver Evaluations Following 125-0 MPH Stops

Driver: Sgt. Flegel

Fade	1
Change in Pedal Feel	1
Pedal Travel	1
ABS Activation	1
Changes in Activation	1
Pull Side to Side	1
Consistency of Performance Issues	1
Under Steer	1
Over Steer	1
Odor/Smoke	1
Noise	1
Roughness Pulsation	1

Ratings: 1=None, 5=Most

Performance Driving Data
Grattan Raceway

Vehicles	Drivers	Lap 1	Lap 2	Lap 3	Lap 4	Lap 5	Lap 6	Lap 7	Lap 8	Average
Car #12 Tahoe	GROMAK	01:43.20	01:43.20	01:42.30	01:42.50	01:42.30	01:42.00	01:42.00	01:42.60	01:42.51
	ROGERS	01:42.00	01:42.50	01:42.20	01:42.80	01:42.50	01:42.50	01:42.70	01:42.50	01:42.46
	MCCARTHY	01:43.50	01:43.30	01:43.70	01:43.90	01:43.90	01:43.90	01:43.60	01:44.10	01:43.74
	FLEGEL	01:43.00	01:42.50	01:41.80	01:42.30	01:42.60	01:42.10	01:42.60	01:42.90	01:42.47
Overall Average										**01:42.80**

This portion of testing shows no appreciable degradation in performance.

Driver Evaluations Following Performance Driving

	Fade	Change in Pedal Feel	Pedal Travel	ABS Activation	Changes in Activation	Pull Side to Side	Consistency of Performance Issues	Under Steer	Over Steer	Odor/smoke	Noise	Roughness/ Pulsation
Flegel	2	2	1	2	1	1	1	1	1	1	1	1
McCarthy	2	3	3	1	1	2	3	2	1	1	1	2
Rogers	2	1	1	1	1	1	1	1	1	1	1	1
Gromack	1	1	1	1	1	1	1	1	1	1	1	1

Ratings: 1=None, 5=Most

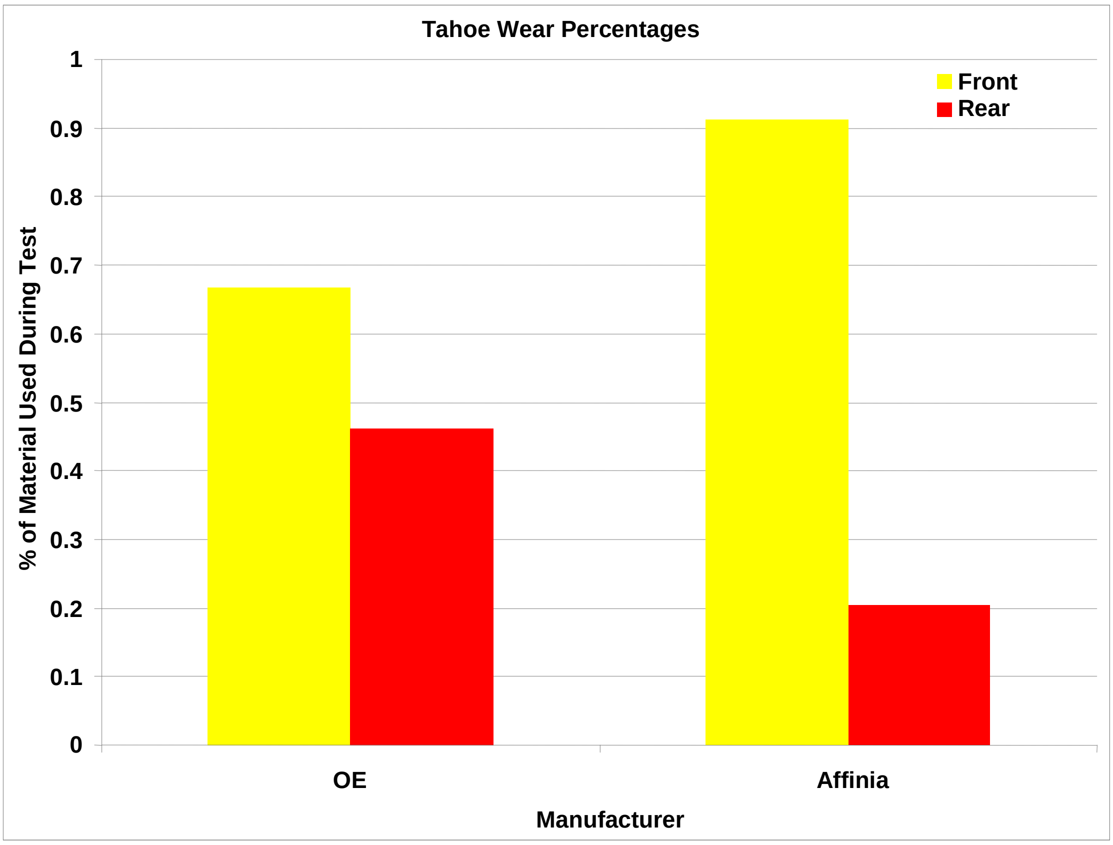
Chevrolet Tahoe 9C1 Wear Data

Percentage of Pad Thickness Consumed During Testing

Affinia's DEL TK-FE aftermarket friction material was the only candidate that qualified for vehicle testing in the Chevrolet Tahoe platform. An OE/OES control sample set was also evaluated in the vehicle test sequence of this project.

The wear results for this pair of brake friction materials are shown in the figure below. Here we see the Affinia DEL TK-FE material produces a higher total wear at the front brake position yet produces a significantly lower wear at the rear brake position when compared to the OE/OES control sample in this particular vehicle configuration.

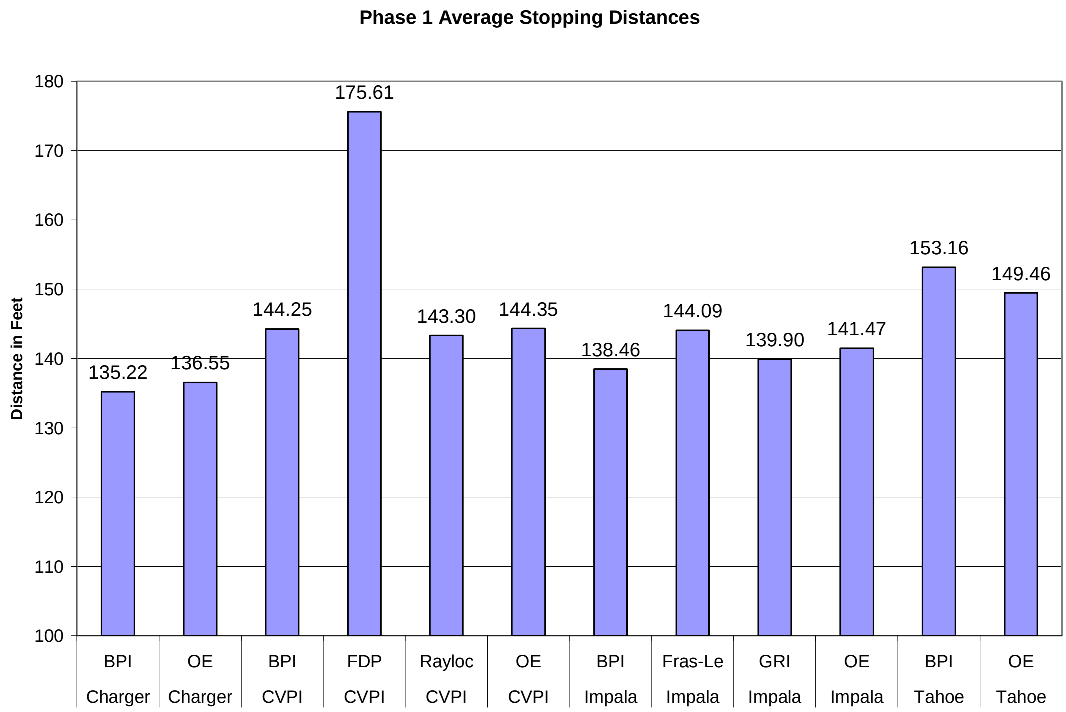
This significant deviation from ideal wear balance may be, in part, attributable to the underlying brake force distribution of the 2010 Chevrolet Tahoe fitted with the Affinia DEL TK-FE friction material and the resulting thermal balance of this system.

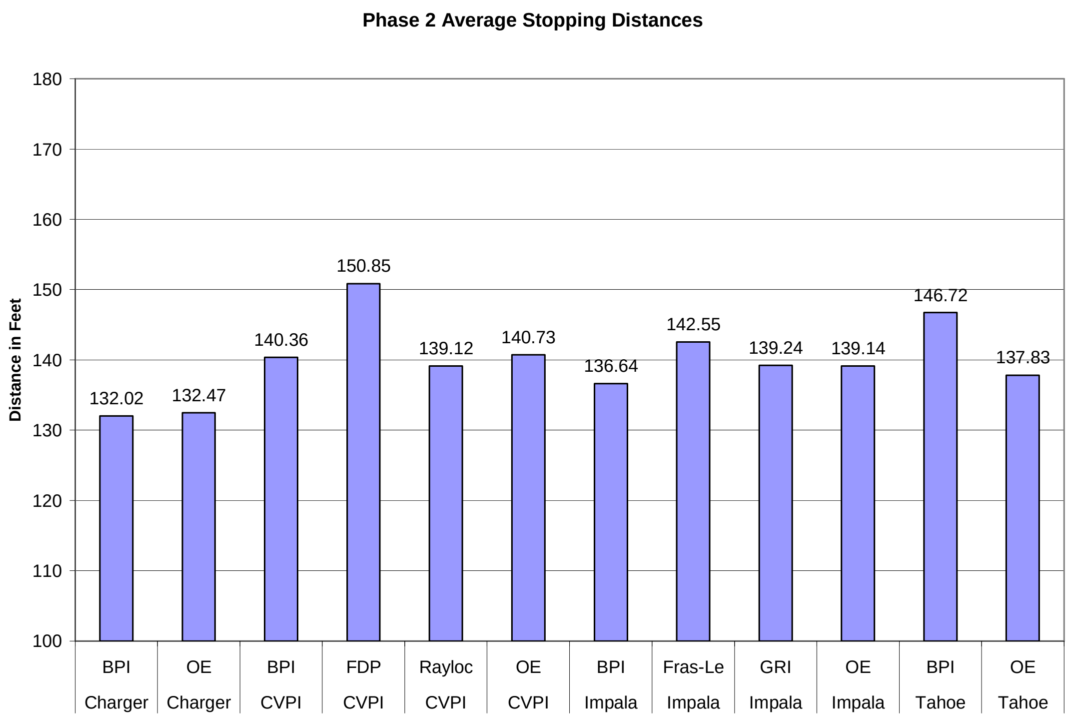


(Please be mindful that the wear figures shown above are not indicative of a normal use lifecycle.)

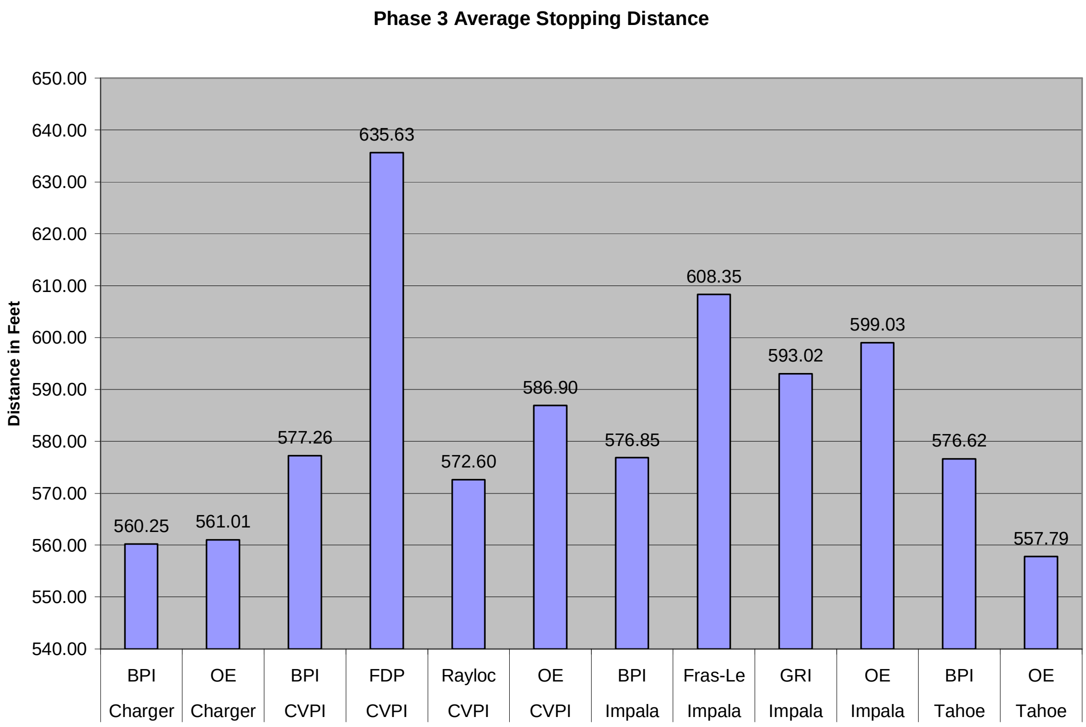
Phases 1 and 2 Stopping Distances

60-0 mph Stops





Phase 3 Stopping Distances
125-0 mph Stops



Summary of Phase 1, Phase 2, and Phase 3 Stopping Distances

Phase 1 and Phase 2 Testing Summary

Stopping Distances Measured in Feet

Vehicle	1	2	3	4	5	6	7	8	9	10	11	12
Platform	Charger	Charger	CVPI	CVPI	CVPI	CVPI	Impala	Impala	Impala	Impala	Tahoe	Tahoe
Manufacturer	BPI	OE	BPI	FDP	Rayloc	OE	BPI	Fras-Le	GRI	OE	BPI	OE
First Series **1**	135.48	142.06	143.51	148.44	143.80	147.22	138.07	144.88	137.22	141.21	154.47	139.89
60-0 mph **2**	130.79	133.79	141.85	152.11	143.91	140.08	138.29	146.70	137.27	140.70	146.53	135.78
Stops **3**	134.23	138.98	144.68	156.72	132.40	145.77	137.62	147.73	140.42	137.69	151.98	138.66
4	133.11	133.53	142.79	167.82	145.43	145.69	138.14	145.44	140.56	140.81	151.20	138.19
5	134.15	136.06	142.56	173.86	144.03	143.20	138.19	145.16	142.91	139.49	151.39	144.62
6	137.49	138.31	142.12	180.55	140.74	143.59	139.01	142.06	141.01	143.50	147.75	156.47
7	137.38	135.75	148.00	189.19	147.12	142.54	141.35	140.51	138.97	142.43	151.50	165.20
8	136.56	134.41	144.11	198.23	141.22	143.01	140.29	141.66	139.41	142.66	153.46	166.62
9	138.14	140.55	150.13	195.53	146.00	145.21	135.05	141.52	137.86	141.80	162.99	159.64
10	134.88	132.09	142.72	193.68	148.37	147.15	138.58	145.26	143.37	144.38	160.39	149.49
Average	**135.22**	**136.55**	**144.25**	**175.61**	**143.30**	**144.35**	**138.46**	**144.09**	**139.90**	**141.47**	**153.16**	**149.46**
St Dev	**2.28**	**3.29**	**2.73**	**18.72**	**4.51**	**2.26**	**1.66**	**2.46**	**2.17**	**1.95**	**5.11**	**11.74**
Second Series **1**	132.27	135.94	142.79	147.25	143.21	144.20	134.87	142.82	139.79	140.57	148.13	135.69
60-0 mph **2**	128.56	132.90	140.72	142.56	140.27	138.91	136.30	138.91	138.53	137.13	142.37	138.54
Stops **3**	131.24	131.27	141.38	144.05	138.72	141.20	136.84	141.76	138.46	136.76	140.33	135.47
4	131.29	132.83	139.64	147.08	138.07	142.33	134.15	143.30	136.11	139.22	145.34	138.41
5	131.89	129.90	139.94	146.83	142.43	141.02	135.40	141.47	137.89	138.82	142.73	137.52
6	128.48	131.57	136.16	147.72	137.80	138.65	137.14	143.66	143.40	138.45	142.72	137.90
7	134.17	134.91	140.93	150.16	137.18	142.36	138.08	143.34	140.63	138.98	144.27	138.66
8	133.20	129.75	140.31	155.02	138.89	143.90	137.76	142.57	137.43	139.77	149.81	137.54
9	135.36	131.84	137.68	162.14	139.82	134.87	138.03	144.91	139.15	139.32	154.67	138.28
10	133.76	133.78	144.07	165.73	134.83	139.83	137.83	142.79	140.98	142.43	156.78	140.29
Average	**132.02**	**132.47**	**140.36**	**150.85**	**139.12**	**140.73**	**136.64**	**142.55**	**139.24**	**139.14**	**146.72**	**137.83**
St Dev	**2.26**	**2.02**	**2.28**	**7.71**	**2.47**	**2.79**	**1.41**	**1.60**	**2.07**	**1.62**	**5.53**	**1.42**

Phase 3 Testing Summary

Stopping Distances Measured in Feet

Vehicle	1	2	3	4	5	6	7	8	9	10	11	12
Platform	Charger	Charger	CVPI	CVPI	CVPI	CVPI	Impala	Impala	Impala	Impala	Tahoe	Tahoe
Manufacturer	BPI	OE	BPI	FDP	Rayloc	OE	BPI	Fras-Le	GRI	OE	BPI	OE

	575.88	571.30	586.93	614.70	588.34	597.35	571.87	615.68	600.36	606.85	596.26	556.59
125-0 mph	559.59	565.05	583.56	618.06	580.95	601.44	566.86	623.13	597.09	597.66	577.00	552.54
stops	560.60	562.42	575.39	613.75	584.51	590.69	580.16	603.66	587.82	596.74	570.64	559.96
	556.13	560.34	577.51	637.73	548.89	573.54	583.24	604.90	599.05	597.40	579.30	557.48
	555.02	555.33	573.58	654.96	562.52	581.50	580.41	600.78	595.31	597.64	572.32	560.45
	554.25	551.62	566.57	674.59	570.40	576.88	578.56	601.97	578.46	597.86	564.22	559.69
Average	**560.25**	**561.01**	**577.26**	**635.63**	**572.60**	**586.90**	**576.85**	**608.35**	**593.02**	**599.03**	**576.62**	**557.79**
St Dev	**8.06**	**7.00**	**7.27**	**24.99**	**15.02**	**11.34**	**6.20**	**8.99**	**8.38**	**3.85**	**10.96**	**2.98**
Average Decel ft/s^2	**30.00**	**29.95**	**29.11**	**26.44**	**29.35**	**28.63**	**29.13**	**27.62**	**28.34**	**28.05**	**29.14**	**30.13**
Average Decel, G's	**0.932**	**0.931**	**0.905**	**0.822**	**0.912**	**0.890**	**0.905**	**0.859**	**0.881**	**0.872**	**0.906**	**0.936**

For Your Information

About the National Institute of Justice

A component of the Office of Justice Programs, NIJ is the research, development and evaluation agency of the U.S. Department of Justice. NIJ's mission is to advance scientific research, development and evaluation to enhance the administration of justice and public safety. NIJ's principal authorities are derived from the Omnibus Crime Control and Safe Streets Act of 1968, as amended (see 42 USC §§ 3721–3723).

The NIJ Director is appointed by the President and confirmed by the Senate. The Director establishes the Institute's objectives, guided by the priorities of the Office of Justice Programs, the U.S. Department of Justice, and the needs of the field. The Institute actively solicits the views of criminal justice and other professionals and researchers to inform its search for the knowledge and tools to guide policy and practice.

Strategic Goals

NIJ has seven strategic goals grouped into three categories:

Creating relevant knowledge and tools

1. Partner with state and local practitioners and policymakers to identify social science research and technology needs.

2. Create scientific, relevant and reliable knowledge — with a particular emphasis on terrorism, violent crime, drugs and crime, cost-effectiveness and community-based efforts — to enhance the administration of justice and public safety.

3. Develop affordable and effective tools and technologies to enhance the administration of justice and public safety.

Dissemination

4. Disseminate relevant knowledge and information to practitioners and policymakers in an understandable, timely and concise manner.

5. Act as an honest broker to identify the information, tools and technologies that respond to the needs of stakeholders.

Agency management

6. Practice fairness and openness in the research and development process.

7. Ensure professionalism, excellence, accountability, cost-effectiveness and integrity in the management and conduct of NIJ activities and programs.

Program Areas

In addressing these strategic challenges, the Institute is involved in the following program areas: crime control and prevention, including policing; drugs and crime; justice systems and offender behavior, including corrections; violence and victimization; communications and information technologies; critical incident response; investigative and forensic sciences, including DNA; less lethal technologies; officer protection; education and training technologies; testing and standards; technology assistance to law enforcement and corrections agencies; field testing of promising programs; and international crime control.

In addition to sponsoring research and development and technology assistance, NIJ evaluates programs, policies and technologies. NIJ communicates its research and evaluation findings through conferences and print and electronic media.

About the Law Enforcement and Corrections Standards and Testing Program

The Law Enforcement and Corrections Standards and Testing Program is sponsored by the Office of Science and Technology of the National Institute of Justice (NIJ), Office of Justice Programs, U.S. Department of Justice. The program responds to the mandate of the Justice System Improvement Act of 1979, which directed NIJ to encourage research and development to improve the criminal justice system and to disseminate the results to federal, state and local agencies.

The Law Enforcement and Corrections Standards and Testing Program is an applied research effort that determines the technological needs of justice system agencies, sets minimum performance standards for specific devices, tests commercially available equipment against those standards, and disseminates the standards and the test results to criminal justice agencies nationwide and internationally.

The program operates through the following:

- The **Law Enforcement and Corrections Technology Advisory Council** (LECTAC), consisting of nationally recognized criminal justice practitioners from federal, state and local agencies, assesses technological needs and sets priorities for research programs and items to be evaluated and tested.

- The **Office of Law Enforcement Standards** (OLES) at the National Institute of Standards and Technology develops voluntary national performance standards for compliance testing to ensure that individual items of equipment are suitable for use by criminal justice agencies. The equipment standards developed by OLES are based on laboratory evaluation of commercially available products in order to devise precise test methods that can be universally applied by any qualified testing laboratory and to establish minimum performance requirements for each attribute of a piece of equipment that is essential to how it functions. OLES-developed standards can serve as design criteria for manufacturers or as the basis for equipment evaluation. The application of the standards, which are highly technical in nature, is augmented through the publication of equipment performance reports and user guides. Individual jurisdictions may use the standards in their own laboratories to test equipment, have equipment tested on their behalf using the standards, or cite the standards in procurement specifications.

- The **National Law Enforcement and Corrections Technology Center** (NLECTC)-National, operated by a grantee, supervises a national compliance testing program conducted by independent laboratories. The standards developed by OLES serve as performance benchmarks against which commercial equipment is measured. In addition, NIJ has begun a new process for developing some standards using Special Technical Committees (STCs), which include practitioners, scientists and subject matter experts. OLES participates in the STC process. The facilities, personnel and testing capabilities of the independent laboratories are evaluated by OLES prior to testing each item of equipment. In addition, OLES helps NLECTC staff review and analyze data. Test results are published in consumer product reports designed to help justice system procurement officials make informed purchasing decisions.

Publications are available at no charge through NLECTC. Some documents are also available online through the Justice Technology Information Network (JUSTNET), the center's World Wide Web site. To request a document or additional information, call (800) 248-2742 or (301) 519-5069 or write:

National Law Enforcement and Corrections Technology Center-National
2277 Research Boulevard
Mail Stop 8J
Rockville, MD 20850
E-mail: asknlectc@nlectc.org
World Wide Web address: http://www.justnet.org

About the National Law Enforcement and Corrections Technology Center System

The National Law Enforcement and Corrections Technology Center (NLECTC) system recently completed a reorganization that will better enable the system to carry out its critical mission to assist state, major city and county, rural, tribal and border, as well as federal law enforcement, corrections and other criminal justice agencies in addressing their technology needs and challenges. Originally created in 1994 as a program of the National Institute of Justice's (NIJ's) Office of Science and Technology, the NLECTC system has realigned its outreach efforts into three new centers: the States, Major Cities and Counties Regional Center; the Small, Rural, Tribal and Border Regional Center; and the Alaska Regional Center.

The States, Major Cities and Counties Regional Center offers a resource and outreach mechanism for state, major city and county criminal justice system partners, with a mission of ensuring that larger criminal justice agencies (those having 50 or more sworn personnel) have unbiased access to a full range of relevant scientific and technology-related information. The Small, Rural, Tribal and Border Regional Center publicizes its programs and services to small, rural, tribal and border agencies across the country. The Alaska Regional Center serves as a conduit for agencies in Alaska.

The efforts of these centers complement those of NLECTC-National, which coordinates NIJ's Compliance Testing program and standards development efforts for a variety of equipment used in the public safety arena, and the Centers of Excellence (CoEs), which support NIJ's research, development, testing and evaluation (RDT&E) efforts in specific portfolio areas. The CoEs focus on the following topic areas: Communications Technologies; Electronic Crime Technology; Forensics Technology; Information and Sensor Systems; and Weapons and Protective Systems. The National Institute of Standards and Technology's Office of Law Enforcement Standards provides scientific and research support to these efforts.

As a whole, the NLECTC system provides:

- Scientific and technical support to NIJ's RDT&E projects.

- Support for the transfer and adoption of technology into practice by law enforcement and corrections agencies, courts and crime laboratories.

- Assistance in developing and disseminating equipment performance standards and technology guides.

- Assistance in the demonstration, testing and evaluation of criminal justice tools and technologies.

- Technology information and general and specialized technology assistance.

- Assistance in setting NIJ's research agenda by convening practitioner-based advisory groups to help identify criminal justice technology needs and gaps.

The NLECTC system supports NIJ's RDT&E process and goal of setting research priorities based on practitioner needs by sponsoring a series of Technology Working

Groups and Constituent Advisory Groups, who provide input to the Law Enforcement and Corrections Technology Advisory Council. Together, these groups form a bridge between the criminal justice community and the NIJ Office of Science and Technology.

For more information, call (800) 248-2742, e-mail asknlectc@nlectc.org or visit http://www.justnet.org.

About the Office of Law Enforcement Standards

The Office of Law Enforcement Standards (OLES) was established as a matrix management organization in 1971 through a Memorandum of Understanding between the U.S. Departments of Justice and Commerce based on the recommendations of the President's Commission on Crime. OLES' mission is to apply science and technology to the needs of the criminal justice community, including law enforcement, corrections, forensic science and the fire service. While its major objective is to develop minimum performance standards, which are promulgated as voluntary national standards, OLES also undertakes studies leading to the publication of technical reports and user guides.

The areas of research investigated by OLES include clothing, communication systems, emergency equipment, investigative aids, protective equipment, security systems, vehicles, weapons, and analytical techniques and standard reference materials used by the forensic science community. The composition of OLES' projects varies depending on priorities of the criminal justice community at any given time and, as necessary, draws on the resources of the National Institute of Standards and Technology.

OLES assists law enforcement and criminal justice agencies in acquiring, on a cost-effective basis, the high-quality resources they need to do their jobs. To accomplish this, OLES:

- Develops methods for testing equipment performance and examining evidentiary materials.
- Develops standards for equipment and operating procedures.
- Develops standard reference materials.
- Performs other scientific and engineering research as required.

Since the program began in 1971, OLES has coordinated the development of standards, user guides and advisory reports on topics that range from performance parameters of police patrol vehicles, to performance reports on various speed-measuring devices, to soft body armor testing, to analytical procedures for developing DNA profiles.

The application of technology to enhance the efficiency and effectiveness of the criminal justice community continues to increase. The proper adoption of the products resulting from emerging technologies and the assessment of equipment performance, systems, methodologies, etc. used by criminal justice practitioners constitute critical issues having safety and legal ramifications. The consequences of inadequate equipment performance or inadequate test methods can range from inconvenient to catastrophic. In addition, these deficiencies can adversely affect the general population when they increase public safety costs, preclude arrest or result in evidence found to be inadmissible in court.